

What is claimed is:

- 1 Sub
2 AI
1. An apparatus for designing a data storage system, comprising:
a data structure stored in computer-readable memory, the data structure
having a plurality of nodes, at least some of the nodes each corresponding to a
physical data storage device having respective attributes;
representations of a plurality of data stores, each data store having
respective requirements; and
a solver process stored in computer-readable memory for assigning the
stores to the data structure based on comparisons of the attributes of the nodes to
the requirements of the data stores wherein the solver process makes a first
assignment of a first store and determines a first metric representative of how well
the first assignment meets one or more goals for the data storage system and
wherein the solver makes a second assignment of the first store and determines a
second metric representative of how well the second assignment meets the one or
more goals and wherein the solver selects one of the first assignment and the
second assignment based on the first and second metrics.
 2. The apparatus according to claim 1, wherein the solver process compares
the requirements of the first store to the attributes of one or more of the data
storage devices and when the comparison indicates compatibility, the solver
process makes the first assignment of the first store.
 3. The apparatus according to claim 2, wherein the plurality of nodes are
arranged in a hierarchy.
 4. The apparatus according to claim 1, wherein the solver process makes at
least one additional assignment of the data store.

1 5. The apparatus according to claim 4, wherein the solver process selects one
2 of the first assignment, the second assignment and the at least one additional
3 assignment based on how well goals for the data storage system are met.

1 6. The apparatus according to claim 1, wherein when the solver process
2 assigns all of the stores to the data structure, the data structure represents a first
3 design for the data storage system and wherein the solver determines a metric
4 representative of how well the first design meets the one or more goals for the
5 data storage system.

1 7. The apparatus according to claim 6, wherein the solver process reassigns
2 at least one of the stores to the data structure thereby forming a second design for
3 the data storage system and wherein the solver determines a metric representative
4 of how well the second design meets the one or more goals for the data storage
5 system.

1 8. The apparatus according to claim 7, wherein the solver process selects one
2 of the first design and the second design based on the first and second metrics.

1 9. The apparatus according to claim 7, wherein the solver process reassigns a
2 plurality of the stores to the data structure to form the second design.

1 10. The apparatus according to claim 7, wherein the solver process reassigns
2 some of the stores to the data structure by removing all of the stores assigned to a
3 particular one of the data storage devices.

1 11. The apparatus according to claim 7, wherein the plurality of nodes are
2 arranged in a hierarchy.

1 12. The apparatus according to claim 1, wherein one or more of said
2 comparisons do not indicate compatibility, the solver process modifies one or
3 more of the attributes of one or more of the data storage devices.

1 13. An apparatus for designing a data storage system, comprising:
2 a data structure stored in computer-readable memory, the data structure
3 having a plurality of nodes, at least some of the nodes each corresponding to a
4 physical data storage device and having respective attributes;
5 representations of a plurality of data stores to be assigned to the data
6 storage system, each data store having respective requirements; and
7 a solver process stored in computer-readable memory for assigning the
8 stores to the data storage devices wherein the solver process compares the
9 requirements of a first one of the stores to the attributes of one or more of the data
10 storage devices and when the comparison indicates compatibility, the solver
11 process makes a first assignment of the first store and when the comparison does
12 not indicate compatibility, the solver process modifies one or more of the
13 attributes of one or more of the data storage devices.

1 14. The apparatus according to claim 13, wherein the solver process makes at
2 least one additional assignment of the data store.

1 15. The apparatus according to claim 14, wherein the solver process selects
2 one of the first assignment and the at least one additional assignment based on
3 how well one or more goals for the data storage system are met.

1 16. The apparatus according to claim 15, wherein when the solver process
2 assigns all of the stores to the data structure, the data structure represents a first
3 design for the data storage system and wherein the solver determines a metric
4 representative of how well the first design meets the one or more goals for the
5 data storage system.

1 17. The apparatus according to claim 15, wherein the plurality of nodes are
2 arranged in a hierarchy.

1 18. The apparatus according to claim 15, wherein the solver process reassigns
2 some of the stores to the data structure thereby forming a second design for the
3 data storage system and wherein the solver determines a metric representative of
4 how well the second design meets the one or more goals for the data storage
5 system.

1 19. The apparatus according to claim 18, wherein the solver process selects
2 one of the first design and the second design based on the first and second
3 metrics.

1 20. The apparatus according to claim 18, wherein the solver process reassigns
2 some of the stores to the data structure by removing all of the stores assigned to a
3 particular one of the data storage devices.

1 21. A method of designing a data storage system, comprising:
2 providing a data structure stored in computer-readable memory, the data
3 structure having a plurality of nodes, at least some of the nodes each
4 corresponding to a physical data storage device having respective attributes;
5 providing a first data store having requirements;
6 comparing the requirements for the first data store to attributes of devices
7 in the data structure;
8 making a first assignment of the first data store to the data structure based
9 on results of said comparing;
10 determining a first metric for the first assignment according to how well
11 the first assignment meets one or more goals for the data storage system;
12 making a second assignment of the first data store based on said results of
13 said comparing;

14 determining a second metric for the second assignment according to how
15 well the second assignment meets the one or more goals for the data storage
16 system; and

17 selecting the first assignment or the second assignment based on the first
18 and second metrics.

1 22. The method according to claim 21, wherein the plurality of nodes are
2 arranged in a hierarchy.

1 23. The method according to claim 21, further comprising modifying the
2 attributes of one or more of the nodes into compatibility with the requirements of
3 the first data store.

1 24. The method according to claim 21, further comprising making at least one
2 additional assignment of the first data store.

1 25. The method according to claim 24, wherein the solver process selects one
2 of the first assignment, the second assignment and the at least one additional
3 assignment based on how well goals for the data storage system are met.

1 26. The method according to claim 21, further comprising:
2 assigning all of a plurality of additional data stores to the data structure
3 and when said assigning all of the additional data stores is completed, the data
4 structure represents a first design for the data storage system; and
5 determining a metric representative of how well the first design meets the
6 one or more goals for the data storage system.

1 27. The method according to claim 26, further comprising:
2 reassigning some of the stores to the data structure thereby forming a
3 second design for the data storage system; and

4 determining a metric representative of how well the second design meets
5 the one or more goals for the data storage system.

1 28. The method according to claim 27, further comprising selecting one of the
2 first design and the second design based on the first and second metrics.

1 29. The method according to claim 27, said reassigning comprising removing
2 all of the stores assigned to a particular one of the data storage devices.

1 30. A method for designing a data storage system, comprising:
2 providing a data structure stored in computer-readable memory, the data
3 structure having a plurality of nodes, at least some of the nodes each
4 corresponding to a physical data storage device having respective attributes;
5 providing a plurality of data stores, each having requirements;
6 comparing the requirements for each data store to attributes of devices in
7 the data structure;
8 making a first assignment of each of the plurality of stores to the data
9 structure based on results of said comparing;
10 determining a first metric for the first assignment according to how well
11 the first assignment meets one or more goals for the data storage system;
12 making a second assignment of each of the plurality of data stores based
13 on said results of the said comparing;
14 determining a second metric for the second assignment according to how
15 well the second assignment meets the one or more goals for the data storage
16 system; and
17 selecting the first assignment or the second assignment based on the first
18 and second metrics.

1 31. The method according to claim 30, wherein the plurality of nodes are
2 arranged in a hierarchy.

1 32. The method according to claim 30, wherein when said comparing does not
2 indicate compatibility, modifying one or more of the nodes.

1 33. The method according to claim 32, said modifying comprising expanding
2 data storage capacity of the one or more nodes.

1 34. The method according to claim 30, said data structure further comprising
2 representations of data storage devices that can be added to a design for the data
3 storage system, but have not been added to the design.

add #2